TRADITIONAL BEACH TEMPLATE VS CROSS SHORE SWASH ZONE (CSSZ) PLACEMENT METHODS AT EGMONT KEY, FL

High Silt Content Beneficial Use Placement

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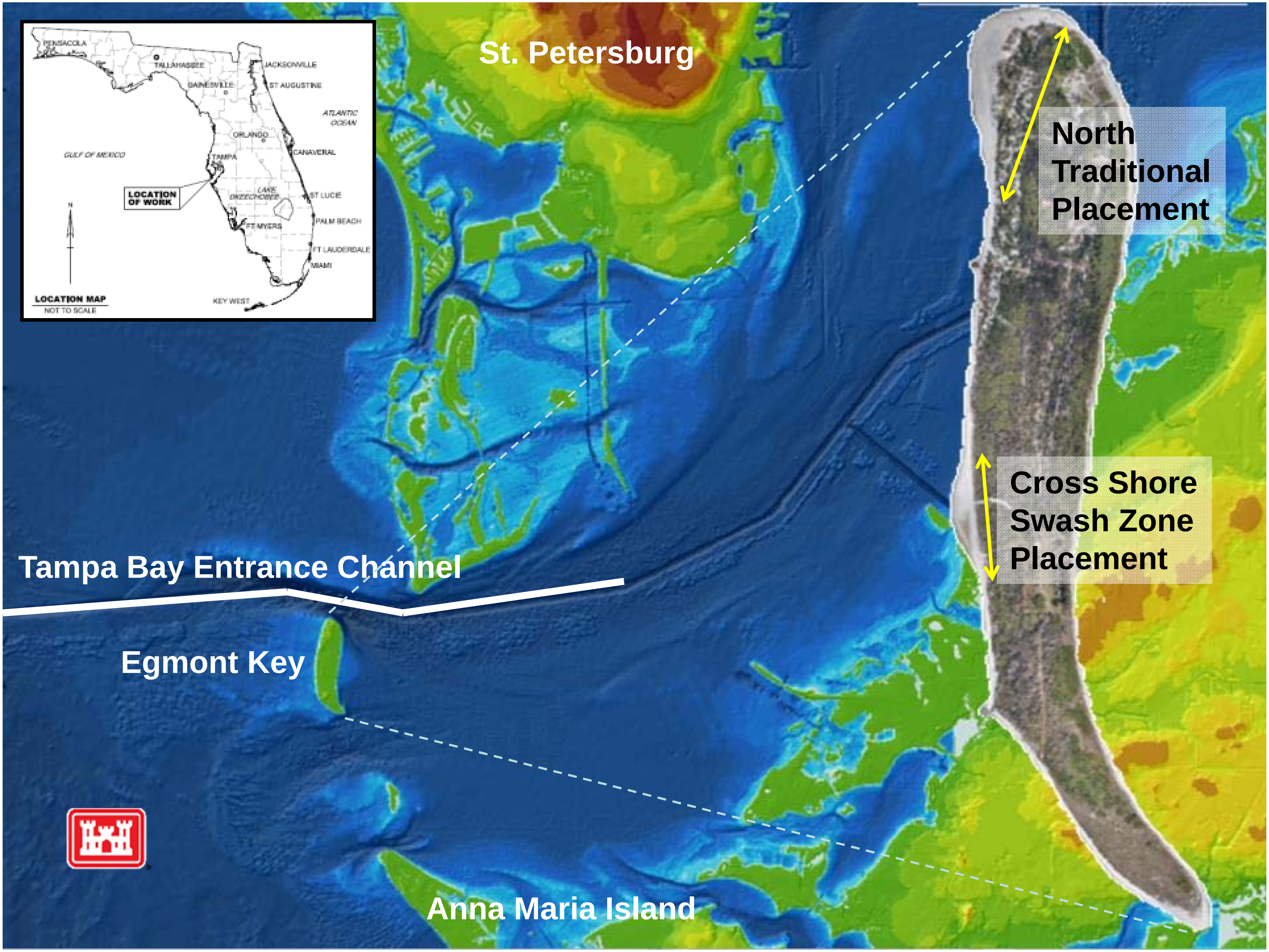
Outline

- **Background**
  - Ideal opportunity for R&D to address environmental concerns and regulations
  - Egmont Key National Wildlife Refuge – “Sand Rule”
  - Material is approx. 20% “fines” (passing 230 sieve)
  - Definitions and Example Projects
  - Beneficial reuse projects – 2001, 2006, and 2011
  - Time series aerials
- **Dredging and Placement**
  - Volumes
  - Compaction - Cone Penetrometer
  - Mass Balance of “fines”
  - Fines Content, Density, Munsell Color
  - Light Attenuation and Turbidity
  - Sea turtle nesting
- **Conclusions**
  - Traditional vs. Cross Shore Swash Zone Placement
  - Acknowledgments



PENSACOLA
TALLAHASSEE
JACKSONVILLE
GAINESVILLE
ST AUGUSTINE
ATLANTIC OCEAN
ORLANDO
GULF OF MEXICO
CANAVERAL
TAMPA
LOCATION OF WORK
LAKE OKEECHOBEE
ST LUCIE
N
PALM BEACH
FT MYERS
FT LAUDERDALE
MIAMI
LOCATION MAP
NOT TO SCALE
KEY WEST
St. Petersburg
North Traditional Placement
Cross Shore Swash Zone Placement
Tampa Bay Entrance Channel
Egmont Key
Anna Maria Island

Definitions

- **Traditional Placement** – placement of material to “build a beach” using longitudinal dikes to increase settlement. This projects purpose is to create a wide flat dry beach berm.

Definitions

- **Cross Shore Swash Zone Placement** (CSSZ) – placement of dredged material by discharging material directly into the swash zone until a delta builds and then extending outfall shore perpendicular thus building a “point” (salient) feature.

21 Feb 15

29 Apr 15

Images Courtesy of GLDD

Case Examples – Mayport 1972

- Cross Shore Swash Zone Placement (CSSZ)

Clean Water Act (CWA)

Case Examples – Sand groynes Delfland 2009

- 3 concentrated nourishments 200k m^3 each
- Uniformly redistributed over a stretch of coast of about 2.5km by the impact of waves and currents
- https://publicwiki.deltares.nl/display/BWN/Building+Block+-+Feeder+beaches+-+Practical+Applications

Case Examples – Delfland Sand Engine 2011

- Concentrated nourishments 28M m^3
- Intertidal ponds were intentional for added habitat
- http://deltaproof.stowa.nl/Publicaties/deltafact/Sand_nourishments.aspx?pId=53#COSTS_AND_BENEFITS

Time-series aerial photos

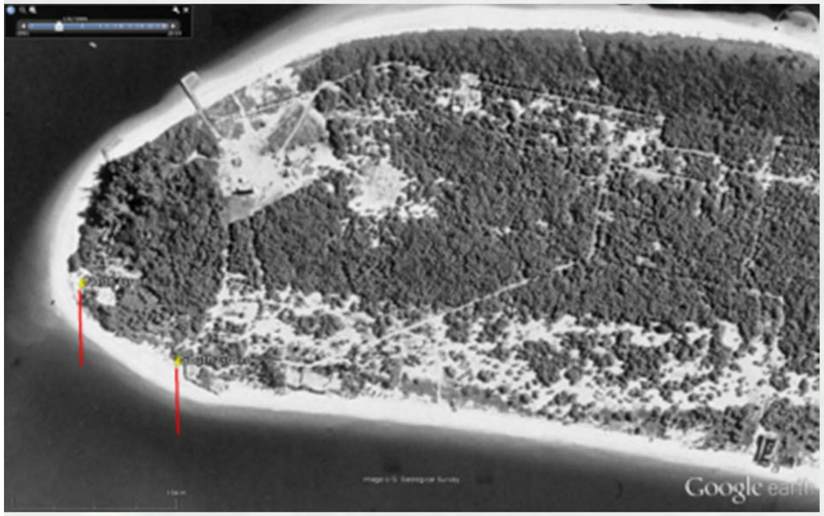
1942

2014 1993 2004 1982 1984

Slides Courtesy of USF

Previous Placement Events

1999



2002

2005

2007

Slides Courtesy of USF

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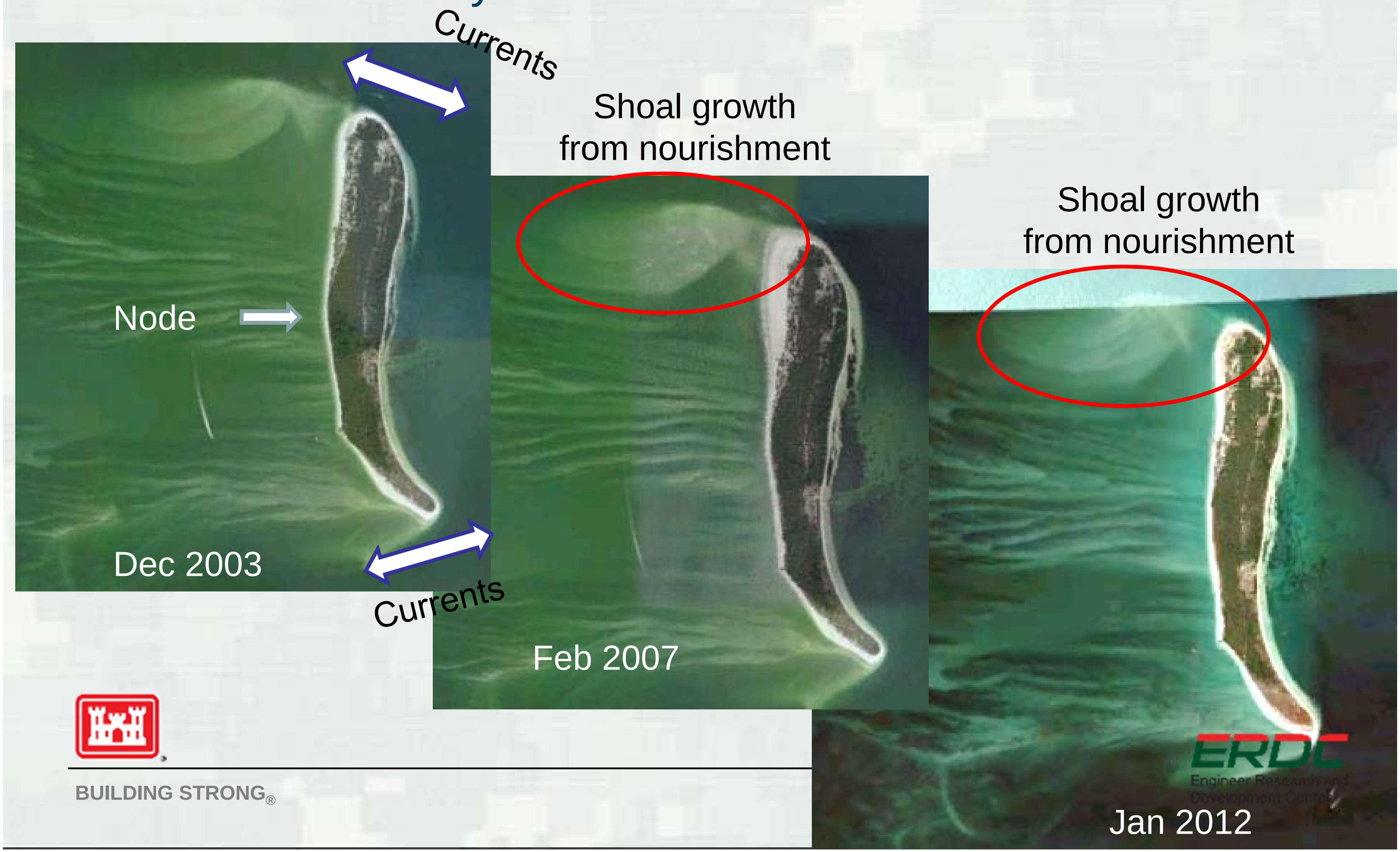
Previous BU – Egmont Key 2001, 2006 & 2011

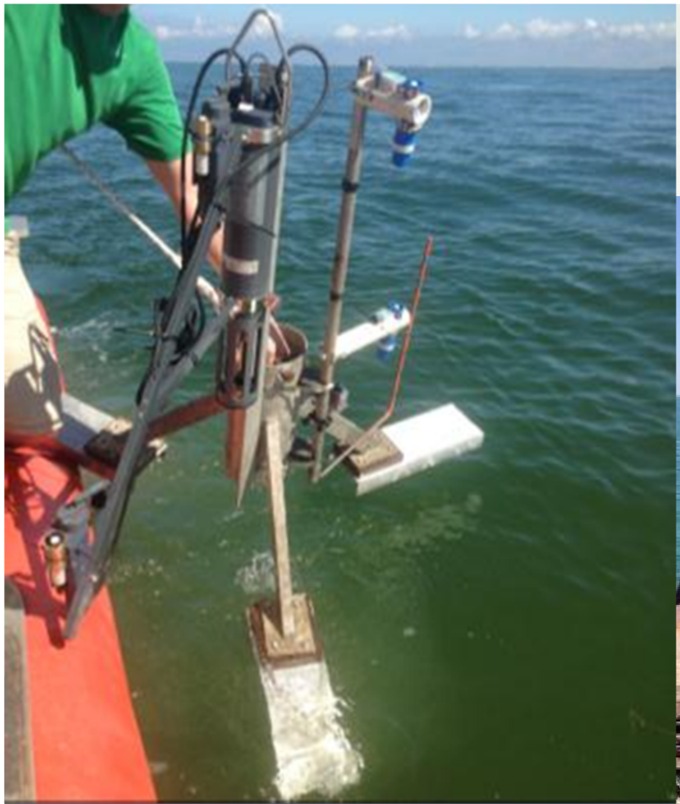
- Ebb dominated system



Dredging and Placement

UAV flight aerial 16 March 2015

Project Monitoring



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Cone Penetrometer

Pre-Placement

Depth (in)	0"-6"	6"-12"	12"-18"
Min (psi)	100	100	198
Max (psi)	580	700	617
Avg (psi)	293	406	457
Median (psi)	295	431	515
# samples	19	19	19
Refusals	1	4	5
% Refusal	5%	21%	26%

Post-Placement

Depth (in)	0"-6"	6"-12"	12"-18"
Min (psi)	50	125	200
Max (psi)	600	700	600
Avg (psi)	328	482	436
Median (psi)	300	500	500
# samples	21	21	21
Refusals	3	6	10
% Refusal	14%	29%	48%

- Increase in refusals due to shell hash areas

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Mass Balance – Egmont Key 2014

Tampa Harbor MD - Egmont Key 2014		
	# of Samples	Sample by weight Fines (passing 230 sieve)
In-situ Channel	80	20.7%
Discharge Slurry	27	18.4% *
Swash zone	27	17.5%
Beach samples	22	0.5%

- Assumptions
  - 100% slurry water conveyed to the wash zone
  - Slurry and swash zone sampling a closed system
- Relationships
  - Swash Zone samples carried 13.2% of the Discharge Slurry fines out of the beach template, thus leaving 5.2% on the beach.

*Sampling methods at discharge slurry not ideal

*Only Traditional Placement

Fines Content and Density

Tampa Harbor MD - Egmont Key 2014		
	# of Samples	Avg. % by wt. passing 230 sieve
In-situ	80	20.7
pre-Beach	6	0.03
post-Dredged	21	0.51
Traditional	14	0.52*
CSSZ	7	0.49 *

Tampa Harbor MD - Egmont Key 2014			
Density	# of Samples	Value avg. (kg/m3)	% Greator
pre-Beach	7	1405.1	0.0%
post-Dredged	17	1471.6	4.7%
Traditional	11	1476.0	5.0%
CSSZ	6	1463.5	4.2%

*Sampling occurred within 72 hours of placement completion

Images Courtesy of GLDD

Munsell Color

Tampa Harbor MD - Egmont Key 2014		
	# of Samples	Value avg.
In-situ	80	4.36*
pre-Beach	13	5.9
post-Dredged	24	5.3
Traditional	16	5.0
CSSZ	8	5.9

*Munsell color value<5 unacceptable for beach placement in Florida

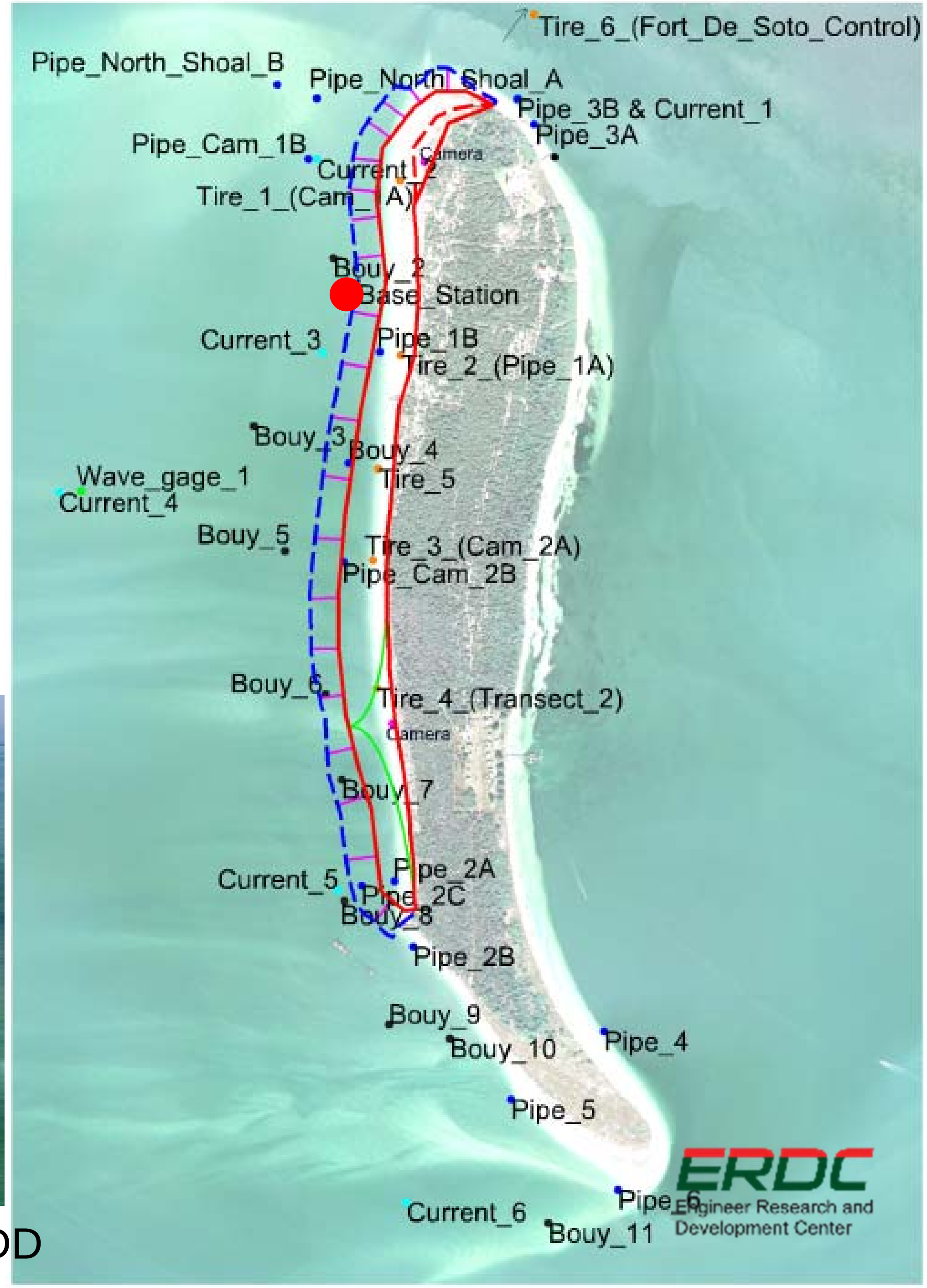
NOTES: Triplicate measurements of hue, value, and chroma were collected from three areas on each moist sand sample using a digital colorimeter (CR-400, Konica Minolta, Osaka, Japan).

Light Attenuation Long-term Monitoring

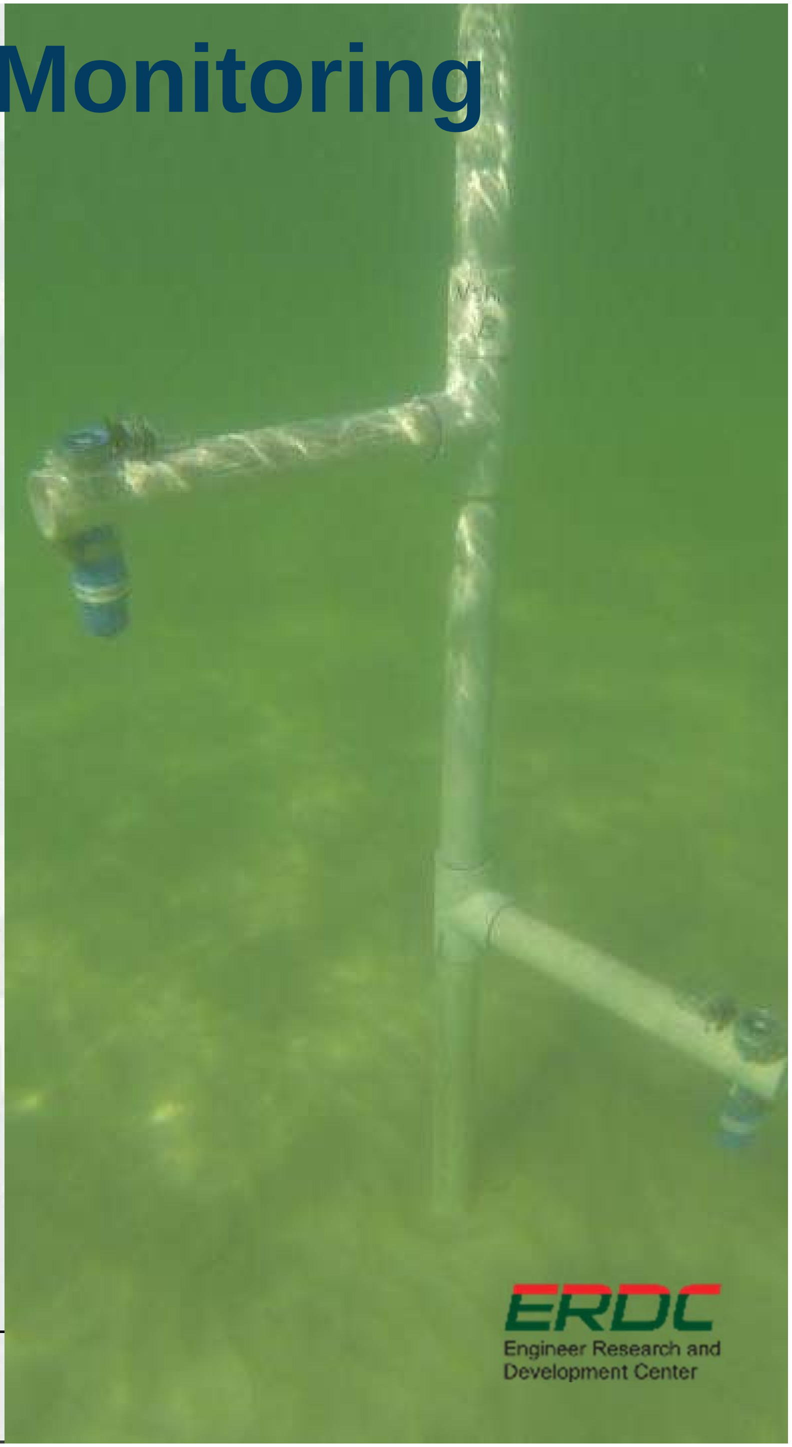
Egmont Key, FL
Long-term
Deployment Map
14 Nov – 15 Dec

BUILDING STRONG®

Image Courtesy of GLDD

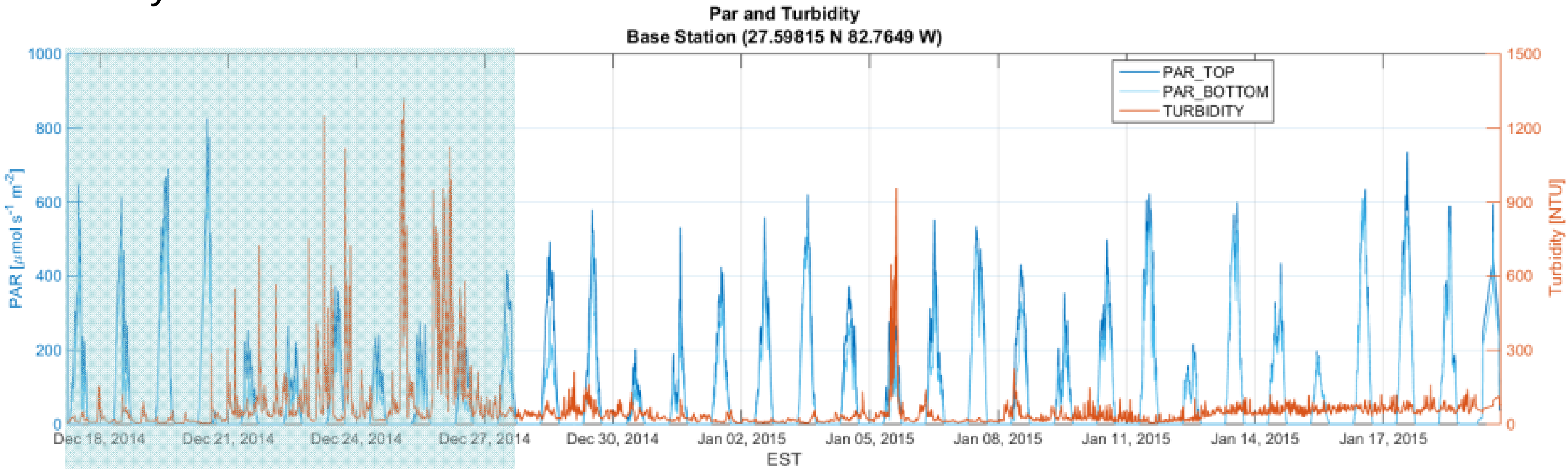


Light Attenuation Monitoring



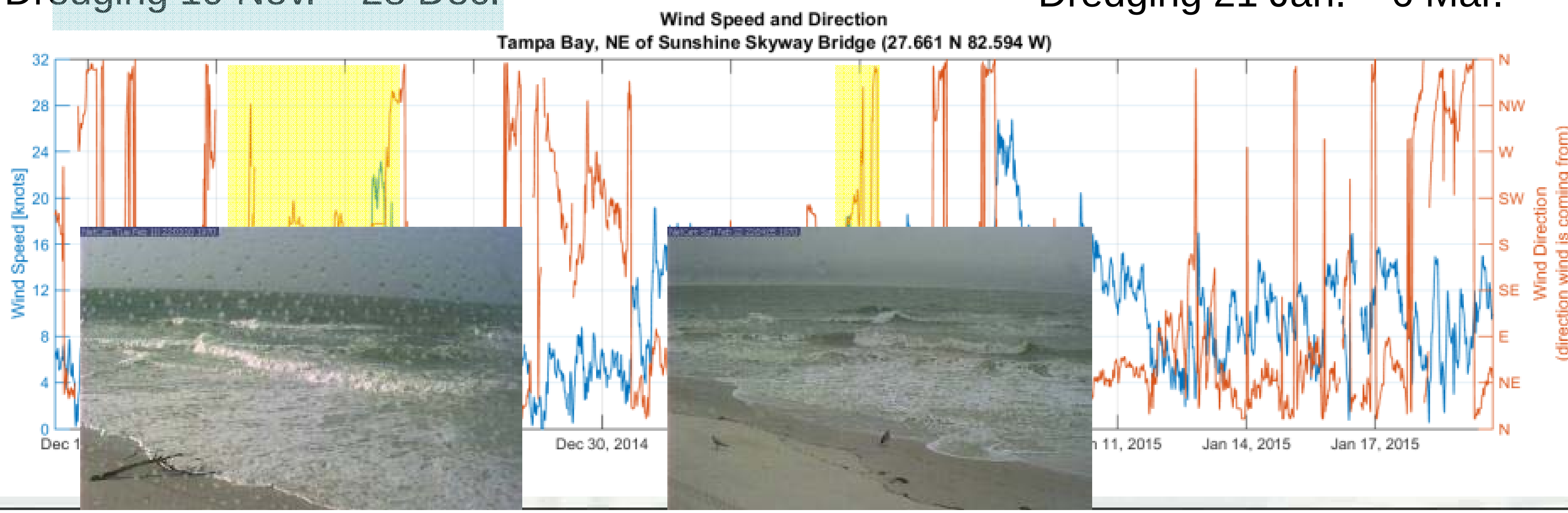
Light Attenuation Long-term Monitoring

Turbidity versus PAR values



Dredging 19 Nov. – 28 Dec.

Dredging 21 Jan. – 6 Mar.



Sea Turtle Nesting 2015

Nesting as of 16 August 2015

CSSZ Drawbacks vs. Traditional Placement

- **Issues**
  - Material is not immediately visible to public
  - Remediation for unacceptable material far more difficult
  - Egmont Key not identical to other projects, low energy, with inlets
  - Each contractor’s crew has their preferred operational techniques: longitudinal dike length, equipment, and methodology
- **Risks**
  - If parameters imposed on nearshore placement are more restrictive this placement method could become more expensive than traditional beach placement
  - Project shutdowns for turbidity
    - Instantaneous vs. chronic

CSSZ Benefits vs. Traditional Placement

- **Less linear feet of beach impacted for equivalent volume**
- **Reduced environmental Impacts**
  - Turtle nest relocations
  - Ponding
  - Cementation
  - Munsell Color
  - Shorebird impacts
- **Lower cost**
  - Construction – less beach equipment
  - Reduced pipeline extensions
  - Maintenance – less escarpment, tilling
- **Reduced beach traditional use impacts**
  - Sunbathing and Water sports
- **Another tool in the BU toolbox**
- **Purely performance based regulations**
  - More beneficial reuse
  - Lower costs - better bids due to more equipment able to perform work

Image Courtesy of GLDD

Conclusions

- CSSZ placement operations within intent of
  "Sand Rule" – reasonable assurance
- CSSZ material spread longshore very quickly
- Grain Size sampling indicates significant "fines" losses
  - 2.4% of original (in-situ) "fines" remaining on beach = 0.5% total
  - 98% of "fines" lost
- Munsell Color and Compaction similar to pre-conditions
- Better RSM practice, better environmental practice, and better economic practice
- Engineering with Nature (EwN)

Image Courtesy of GLDD

Acknowledgments

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Thank You!

Questions?

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